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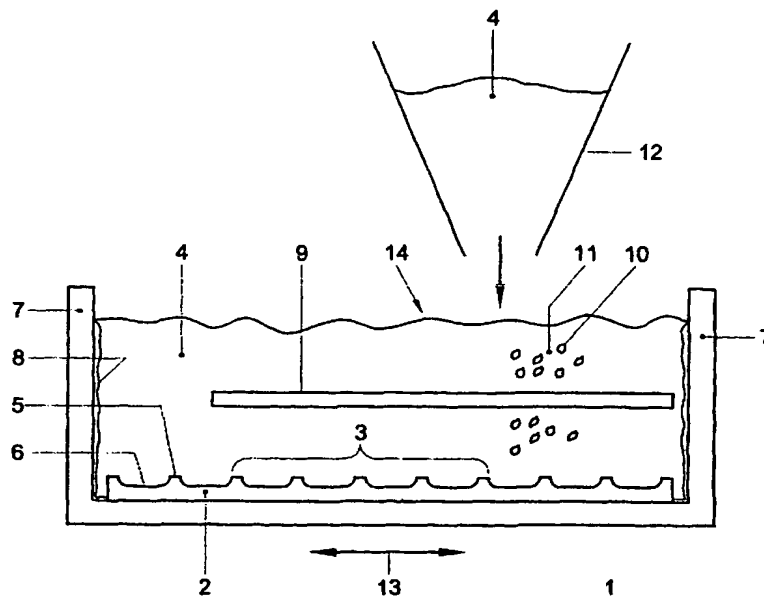
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(54) Title: CONCRETE ELEMENT



(57) Abstract: Method for manufacturing a prefab concrete constructional element, wherein concrete is brought into a molding space for defining the shape of the element. The molding space comprises at least one wall provided with a plastic lining layer. The lining layer has a profile which is the mirror image of a profile to be provided in the concrete. The profile is formed by relatively small projections and recesses. The lining layer can be manufactured by removing it as a layer from a profiled surface on which plastic has been poured and has hardened and which surface has a profile which is to be provided in concrete.

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Title: Concrete element

The invention relates to a method for manufacturing a prefabricated concrete constructional element, wherein liquid concrete is brought into a molding space for defining the shape of the element and, after hardening of the concrete, removing the manufactured concrete constructional element from the molding space. The invention also relates to a concrete constructional element manufactured according to such a method, and to a mold for manufacturing such a concrete element.

As is known, concrete constructions which are manufactured using a conventional casting mold, made, for instance, from wood or from steel, comprise substantially smooth surfaces. This is understood to mean surfaces which are substantially wholly located in one or more geometrical planes; relatively small irregularities, such as incidental bumps or pits in an otherwise flat surface also fall under the term "smooth". A concrete element having a surface formed by several geometrical planes is, for instance, an element with a pattern of lines or regular elevations and/or recesses in the concrete surface. Patterns of a greater complexity cannot be realized with a conventional manufacturing technique: if there is an undue amount of, particularly intersecting, projections and recesses, the contact surface between concrete and mold increases unduly, so that the shaped, hardened concrete can no longer be released from the mold.

When in a concrete construction it is desired to provide a relief, for instance a functional relief with a certain surface roughness, use is often made of a cladding of a different material which is applied to the concrete construction. Use is also made of a manual stamping technique, whereby hardening concrete is manually roughened in situ. The drawback of such constructional elements is that providing these elements with a relief by separate cladding or by means of a manual stamping technique is rather costly.

The object of the invention is to remove this drawback and to provide a method for manufacturing a prefab concrete constructional element, wherein such drawbacks do not occur, and wherein a thus manufactured element shows a high degree of uniformity and can be manufactured in large quantities at considerably lower costs.

This object is achieved with a method according to the preamble, wherein at least a part of the molding space is provided with a profiled surface by applying a plastic lining layer having a profile directed towards the molding space and consisting of relatively small, differently directed projections and recesses. In a particular embodiment, the lining layer of the molding space can be manufactured by pouring plastic onto a surface to be imitated and by peeling the plastic, after hardening, as a layer from the imitated surface.

In particular, the method according to the invention offers the possibility of providing a much more detailed profile in the concrete than is possible with the current techniques. The invention makes it possible to produce pre-formed concrete elements having a highly faithful paving pattern or profile, while for instance paving stones or clinkers or other parts of a pavement can be imitated in the concrete. By using colorants, for instance in surface conditioning agents or mixed into the concrete as a whole, colors can be added, which give the whole a still more faithful appearance. The concrete elements can have any desired size, in practice, for instance, a dimension of 2x2 m, so that a street can be rapidly and easily provided with pavement, including all desired colors, patterns and provisions. The latter includes, for instance, elements provided with expansion joints, cable ducts, drainage provisions, et cetera. As all these provisions can be prefabricated into the elements, the paving work in situ is considerably less labor-intensive. The same holds for work on a pavement: in that case, the relatively large modular elements can be readily picked up and moved, so that work on, for instance, cables or sewerage is easier to perform.

In a specific embodiment, as molding space, an open, box-like construction with the plastic lining layer as bottom can be used, and the

concrete can be poured onto the lining layer. The lining layer may then be fixedly connected with the wall of the space. The plastic lining layer can be designed to be so flexible that it can be removed from the concrete by peeling. The embodiment mentioned offers the advantage of a manufacturing method
5 whereby large production quantities can be easily achieved, while the hardening is not very critical and three-dimensional shapes can be easily manufactured; coloring the concrete, however, is less easy. By applying colored concrete, a coloring can be achieved.

In another embodiment, a more specific surface treatment can be applied,
10 whereby the lining layer is pressed into hardening concrete. Although, for instance, the lining layer can be provided on a roller, so that, through a rotary movement, a pattern is pressed into the hardening concrete surface, the lining layer is preferably provided on a flat carrier, which, held substantially parallel to a hardening concrete surface, is subsequently pressed into it, while air
15 present between the lining layer and the concrete escapes through breather ducts provided in the lining layer. An advantage of such a planar pressure is that concrete is not pushed to one or the other side of a molding space, but is subject to a neat uniform impression. This embodiment offers the possibility of applying to the concrete surface into which the lining layer is pressed a
20 conditioning agent which causes accelerated hardening of the concrete surface. Such a conditioning agent is, for instance, a colored surface conditioning agent (Colored Surface Hardener, CSH). By using such a conditioning agent, very specific surface colorings can be applied and the faithfulness of the concrete profiled element is further enhanced.

25 The invention further relates to a prefab concrete constructional element manufactured by a method according to the above mentioned aspects, which element has at least one side provided with a profile which is formed by relatively small, differently directed projections and recesses. The element can be a plate-shaped, modular element with relatively large dimensions in
30 comparison with the current (manually) profiled elements, such as paving

stones, and, if so desired, is provided with a reinforcement suitable for application in large concrete constructions, such as, for instance, a parking deck. The element can have a profile representing a pavement pattern.

5 The invention further relates to a mold for application in the method according to any one of the above-mentioned aspects, which mold is at least partly provided with a plastic lining layer having a profile which is the counter-profile of a profile to be provided in the concrete and which is formed by relatively small, differently directed projections and recesses. The mold can be provided with breather ducts, which are provided in the projections or
10 recesses. Such an embodiment offers as an advantage that substantially no visual traces of the breather ducts are left in the concrete element. The mold can be provided with guiding means for pressing the mold onto the surface in a straight line, transversely to a hardening concrete surface.

The profile of the mold can be the counterform of a paving pattern.
15 Different sorts of plastic can be applied, for instance flexible polymers, such as polyethylene. Polyurethane offers advantages, inter alia because of its durability and concrete-releasing properties.

The invention will be further elucidated on the basis of the drawing. In the drawing:

20 Fig. 1 shows a schematic cross section of a concrete element which is cast in a mold according to a first embodiment of the method;

Fig. 2 shows a schematic representation of the removal of the concrete element from the mold of Fig. 1;

25 Fig. 3 shows a schematic cross section of a mold for a curved profiled surface;

Fig. 4 shows a schematic cross section of a concrete element, wherein according to a second embodiment of the method a profile is pressed into a top layer;

30 Fig. 5 shows a perspective representation of the manufacture of a lining layer according to the invention.

In Fig. 1, a casting mold 1 is represented, with a plastic lining layer 2 provided as a profiled mat on the bottom. The mat is provided with a profile 3, which is the mirror image of a profile to be provided in the concrete 4, and is formed by relatively small projections 5 and recesses 6, in the form of a pavement profile. The mat 2 can be glued to the bottom or clamped onto it. The mat 2 can also be detachably fitted. In that case, the plastic needs to be sufficiently supple and elastic to be removed from the hardened concrete by peeling. A possible plastic which satisfies these properties is polyurethane. The casting mold can be comprised of detachable wall parts 7, which can each be lined with a profiled layer according to the invention, or which consist of flat wooden, metal or concrete wall parts.

To promote demolding, use can be made of a layer of powdery or liquid mold-release agent 8; this agent can be applied to each of the walls of the casting mold and to the mat 2. In the concrete 4, a reinforcement 9 can be incorporated. More in general, the concrete can comprise gravel 10 and sand cement 11, but also filler, plastic or combinations thereof. Additionally, colorants can be added. The concrete 4 is poured from a chute 12 into the casting mold 1. By means of a vibrating mechanism, schematically represented by reference numeral 13, the concrete 4 can rapidly spread through the entire mold, and the top surface 14 of the concrete is levelled.

According to the embodiment represented in Fig. 2, the concrete element can be removed from the casting mold 1 by inverting the mold. The bottom with the mat 2 provided therein will then be in an upper position. With the help of a hinge construction 15, the mold 1 can be pulled from the concrete 4. Because of its releasing properties, the plastic mat 2 is released, possibly in a peeling way, and the concrete profile 16 becomes visible.

In Fig. 3 it is represented how a more three-dimensional profile form can be achieved with the aid of the method according to the invention. Such forms are for instance suitable for application as (curved) profiled wall parts or other concrete profiled plates, such as sound-damping walls and the like. The

method uses a casting mold 17, whose bottom is provided with a curved surface 182, which is the mirror image of the element to be formed.

In Fig. 4 it is represented how, according to a second embodiment of the method, a profile is pressed into a top layer of concrete. To that end, a conventional casting mold 19, provided, for instance, with wooden, concrete or steel walls 20 and provided with a conventional release agent (not shown), is filled with concrete. Then, a layer 21 is applied, with a surface conditioning agent (CSH) to promote hardening, and reinforcing and coloring the concrete layer 14.

Then, a mold-release agent 22 is strewn on the layer 21. This mold-release agent may also be colored, so that a color shade can be obtained together with the surface conditioning agent. Finally, a flat carrier 23 on which a lining layer according to the invention has been provided is pressed onto the concrete layer. By means of a guiding element 24, the carrier 23 is held substantially parallel to the hardening concrete surface, and pressed onto the surface in the direction of arrow Q, while air present between the lining layer and the concrete escapes (as represented by arrows P) through breather ducts 25 provided in the lining layer. For clarity's sake, only a few breather ducts 25 are represented in the figure, arranged in projections 26 or recesses 27, so that in the concrete element substantially no traces of them are left. Any residual unevenness can be removed prior to definitive hardening, for instance by means of a brushing treatment.

Finally, Fig. 5 represents, partly in perspective view, partly in cross section, an embodiment of the manner of manufacturing the plastic profiled layer 28 for use in the method according to the invention. For a high degree of faithfulness to, for instance, a clinker pavement, use can simply be made of a "real" pavement 29, optionally prepared to that end, which has the profile intended to be provided in the concrete. This pavement is cleaned and prepared with an upright edge 30, and subsequently a layer of viscous polyurethane 31 is poured onto it. The layer cures to form a plastic layer 28

having a profiling which has a profile that is to be provided in concrete. Then the layer 28, as has been explained hereinabove, can be fitted on the bottom of a casting mold or to one of the walls thereof.

Although the discussion in the foregoing concerned the case of the
5 manufacture of a concrete element to be used as pavement, it will be clear to the skilled person that other profiles, of a functional or decorative nature, such as logos and the like, can also be provided. The method is eminently suitable for forming "natural" surfaces, whereby the concrete can obtain the
10 appearance of natural materials such as real clinker pavement, or a wooden profile or other. Such natural surfaces have a profile which is characterized by relatively small, differently directed projections and recesses. The method according to the invention can also be applied more in general for manufacturing random shapes, both in one plane and more three-dimensional forms. The concrete elements can be used as paving element, but also as wall
15 or ceiling elements or different constructional elements. The method can also be used for (re)furnishing existing concrete elements with a profiled layer. The method can be applied in combination with all kinds of known pre- and post-treatments, such as heating, glazing, ageing processes, et cetera.

It will be clear to the skilled person that the invention is not limited to
20 the exemplary embodiments described on the basis of the drawing, but that it can comprise all sorts of variations thereon. Such variations are understood to fall within the scope of protection of the following claims.

CLAIMS

1. A method for manufacturing a prefab concrete constructional element, wherein liquid concrete is brought into a molding space for defining the shape of the element and, after hardening of the concrete, removing the manufactured concrete constructional element from the molding space,
5 characterized in that at least a part of the molding space is provided with a profiled surface by providing a plastic lining layer having a profile directed towards the molding space and consisting of relatively small, differently directed projections and recesses.
2. A method according to claim 1, characterized in that the lining layer is
10 manufactured by pouring plastic on a surface to be imitated and by peeling the plastic, after hardening, as a layer from the imitated surface.
3. A method according to at least one of the preceding claims, characterized in that, as a molding space, an open, boxlike construction with the plastic lining layer as bottom is used, and the concrete is poured onto the
15 lining layer.
4. A method according to claim 3, characterized in that the lining layer is fixedly connected to a wall of the molding space.
5. A method according to claim 3 or 4, characterized in that the plastic lining layer is designed to be so flexible that it can be released from the
20 concrete by peeling.
6. A method according to at least one of the preceding claims, characterized in that the lining layer is pressed into hardening concrete.
7. A method according to claim 6, characterized in that the lining layer is provided on a flat carrier, which is held substantially parallel to a hardening
25 concrete surface and is subsequently pressed into that surface, while air present between the lining layer and the concrete escapes via breather ducts arranged in the lining layer.

8. A method according to claim 6 or 7, characterized in that on the concrete surface into which the lining layer is pressed, a conditioning agent is provided which causes accelerated hardening of the concrete surface.
9. A prefab concrete constructional element, manufactured according to a method according to at least one of the preceding claims, characterized in that at least one side of the element is provided with a profile which is formed by relatively small, differently directed projections and recesses.
10. An element according to at least one of claims 9, characterized in that the element is a plate-shaped modular element of relatively large dimensions.
11. An element according to claims 9-10, characterized in that the profile represents a paving pattern.
12. A mold for use in a method according to at least one of claims 1-8, characterized in that at least a part of the mold is provided with a plastic lining layer having a profile which is the counter-profile of a profile to be provided in the concrete, and which is formed by relatively small, differently directed projections and recesses.
13. A mold according to claim 12, characterized in that the mold is provided with breather ducts.
14. A mold according to claim 13, characterized in that the breather ducts are provided in the projections.
15. A mold according to claim 13 or 14, characterized in that the breather ducts are provided in the recesses.
16. A mold according to at least one of claims 12-15, characterized in that the mold is provided with guiding means for pressing the mold onto the surface in a straight line, transversely to a hardening concrete surface.
17. A mold according to at least one of the preceding claims 12-16, characterized in that the profile is the counter-profile of a paving pattern.
18. A mold according to at least one of the preceding claims 12-17, characterized in that the plastic comprises polyurethane.

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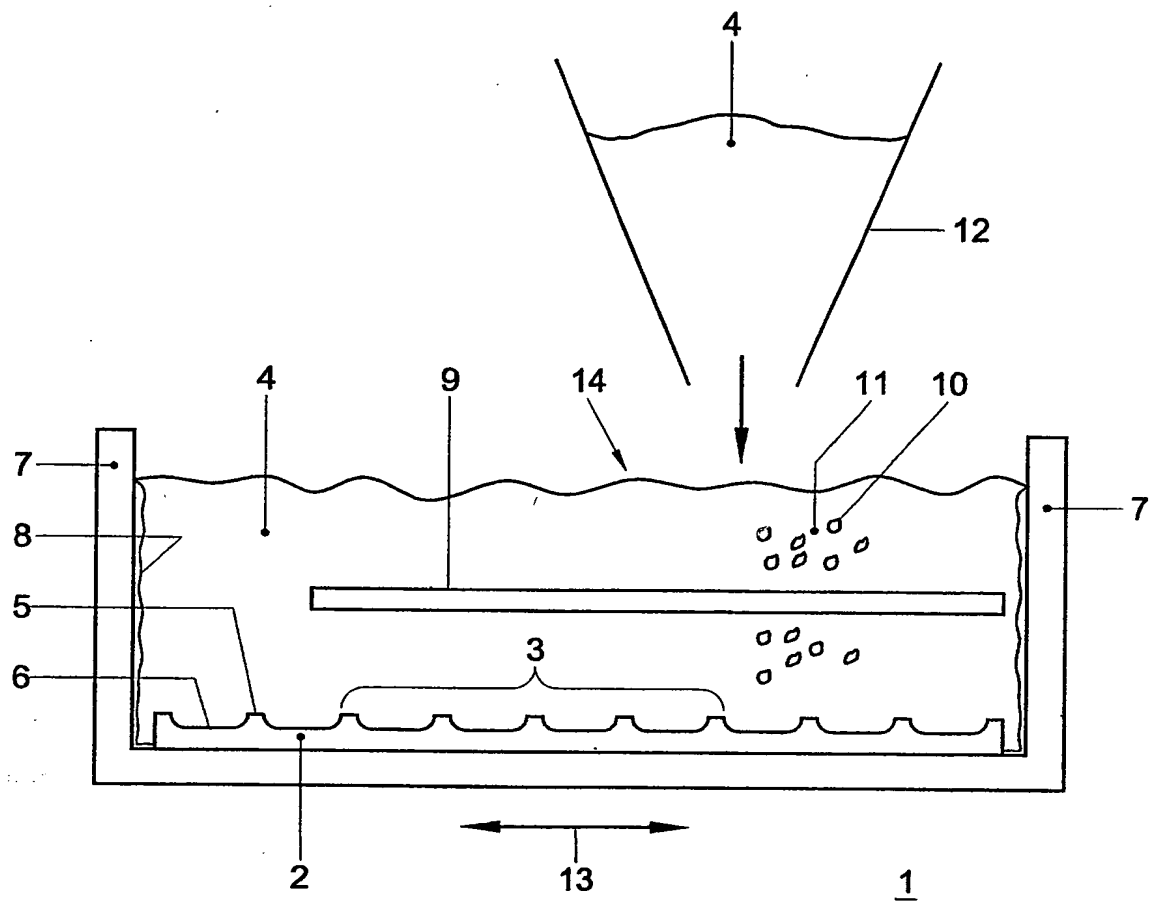


Fig. 1

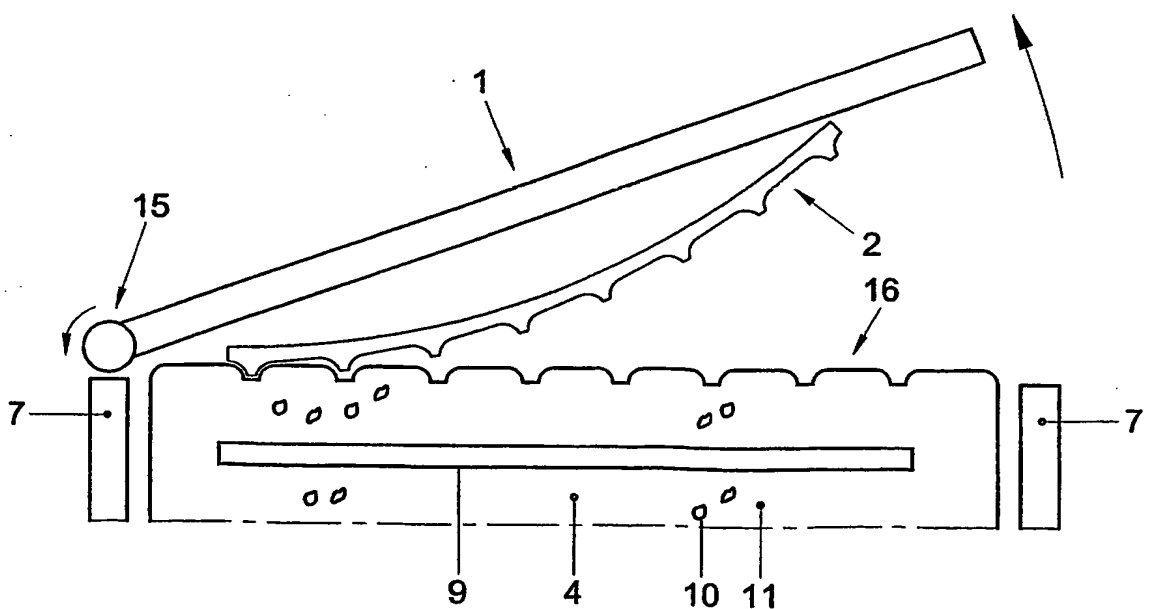


Fig. 2

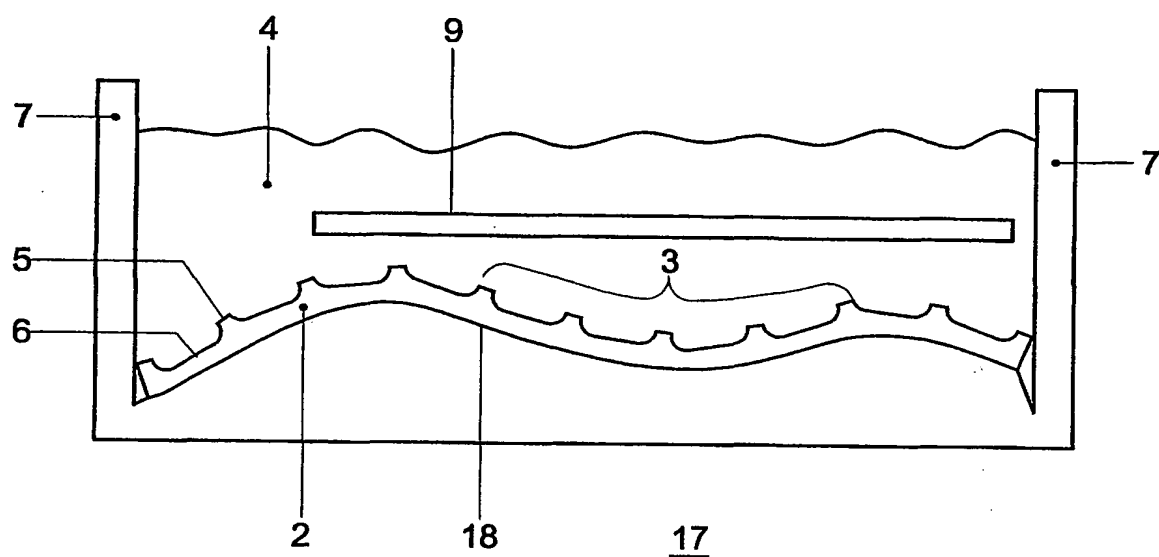


Fig. 3

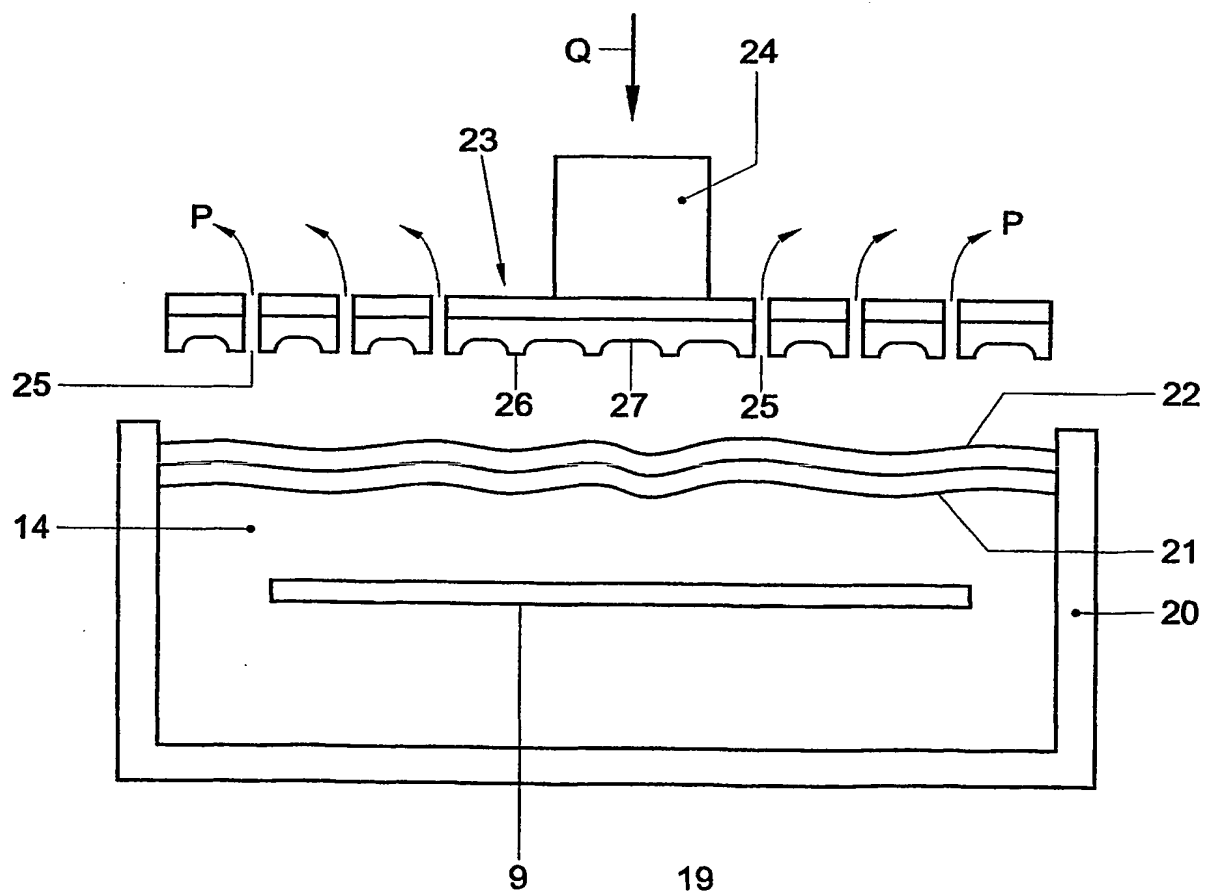


Fig. 4

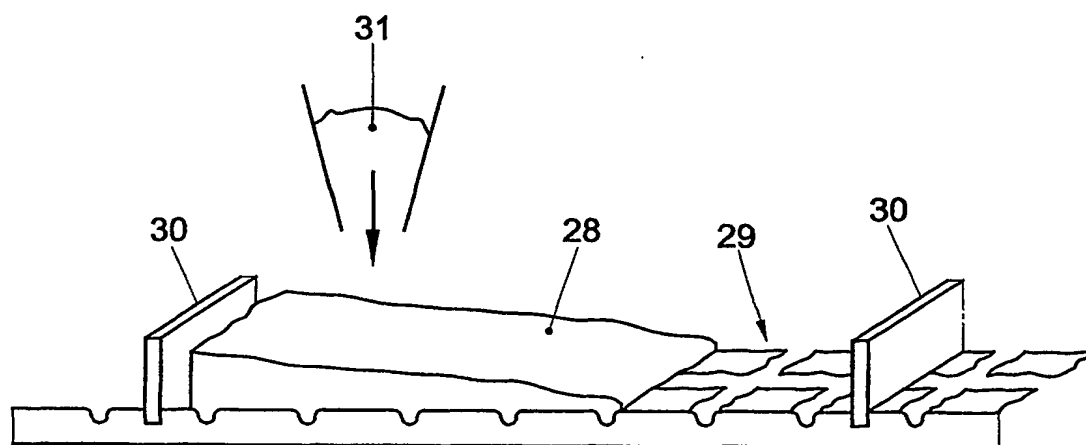


Fig. 5

Internal Application No.

PCT/NL 00/00946

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B28B7/36 B28B7/00 B28B3/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B28B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	page 3, line 18-30 claims 1, 5, 6; figures 1, 2	10, 12 13-15
X	DE 95 834 C (WENZL VLCEK) 28 January 1898 (1898-01-28) the whole document	1, 3, 5, 12
X	DE 31 35 979 A (REUSS PETER) 31 March 1983 (1983-03-31) page 3, paragraph 1 page 5, last paragraph -page 6, last paragraph figures 1-4	1, 3, 5, 9-12, 17, 18
	-/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

Intern Application No
PCT/NL 00/00946

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Interr. Application No

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